



Establishing timber as a preferred material for construction

# Mechanical Properties of Scots Pine Structural Timber

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Strategic Integrated Research in Timber

- Mechanical properties
- Sources of variation
- Links to acoustics
- Discussion



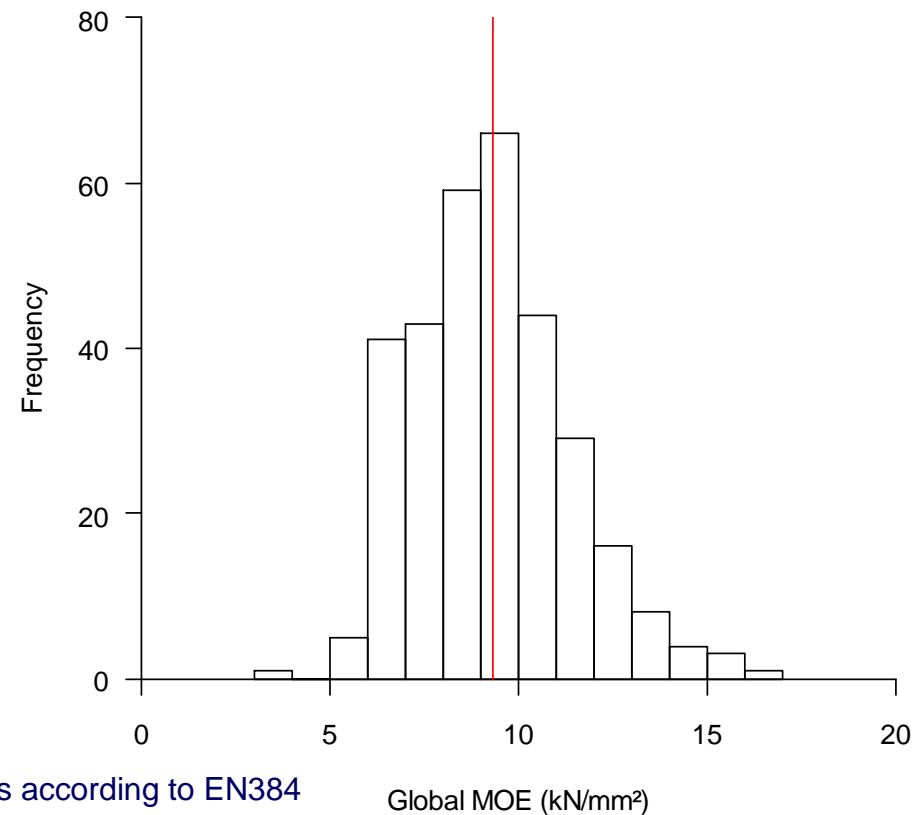
Stand	OS Grid	Quality	Age (years)	DBH (cm)	Height (m)
Cawdor	NH 886 489	Good	79	33.6	19.5
Munlochy	NH 624 535	Medium	81	34.7	21.6
Harriets	NH 776 926	Poor	77	32.0	18.9

Stand	Number of samples		
	100x47 mm	200x47 mm	Total
Cawdor	83	26	109
Munlochy	57	54	111
Harriets	75	26	101
Total	215	106	321

- Acoustic NDT measurement of stiffness (MOE)
- 4-point bending test for strength (MOR) and stiffness
- Gravimetric sample for basic density & moisture content

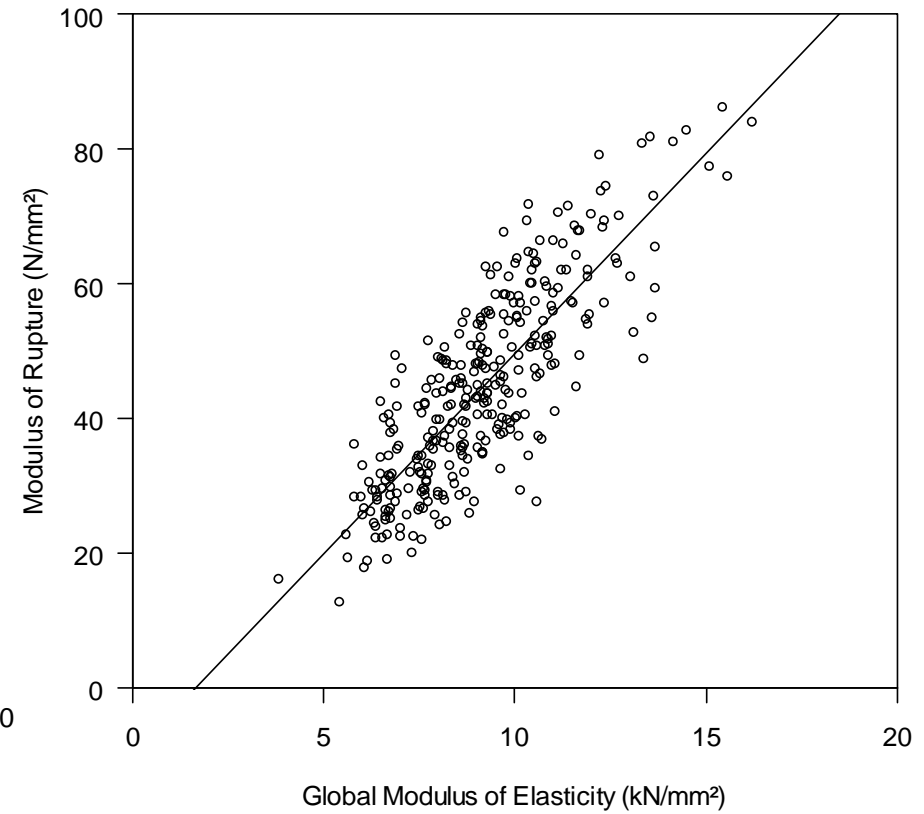
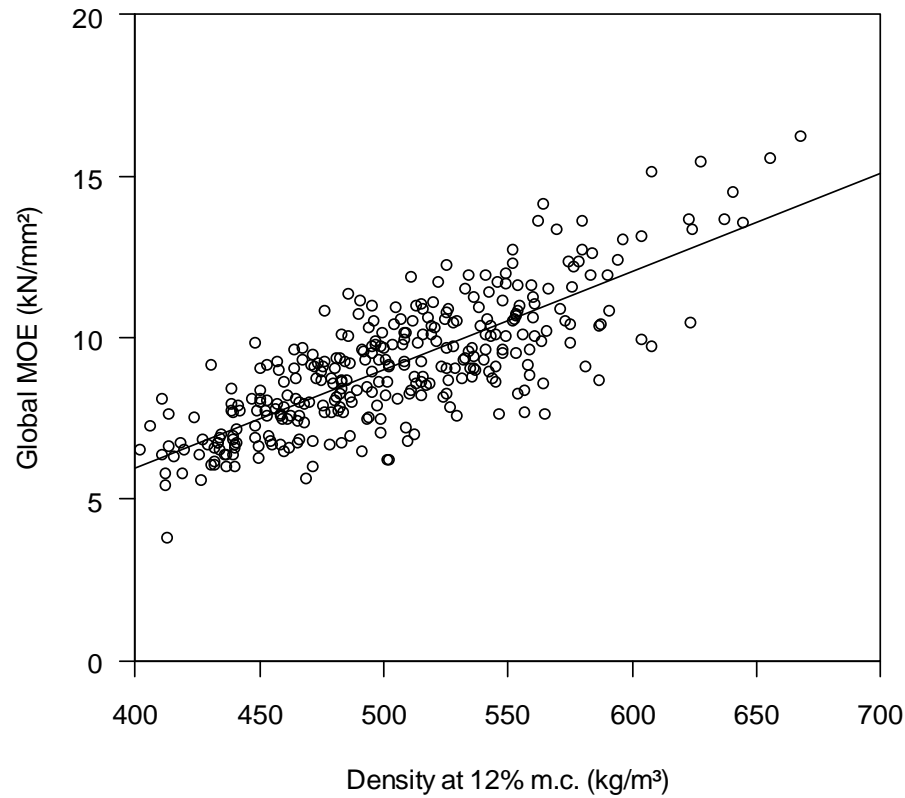


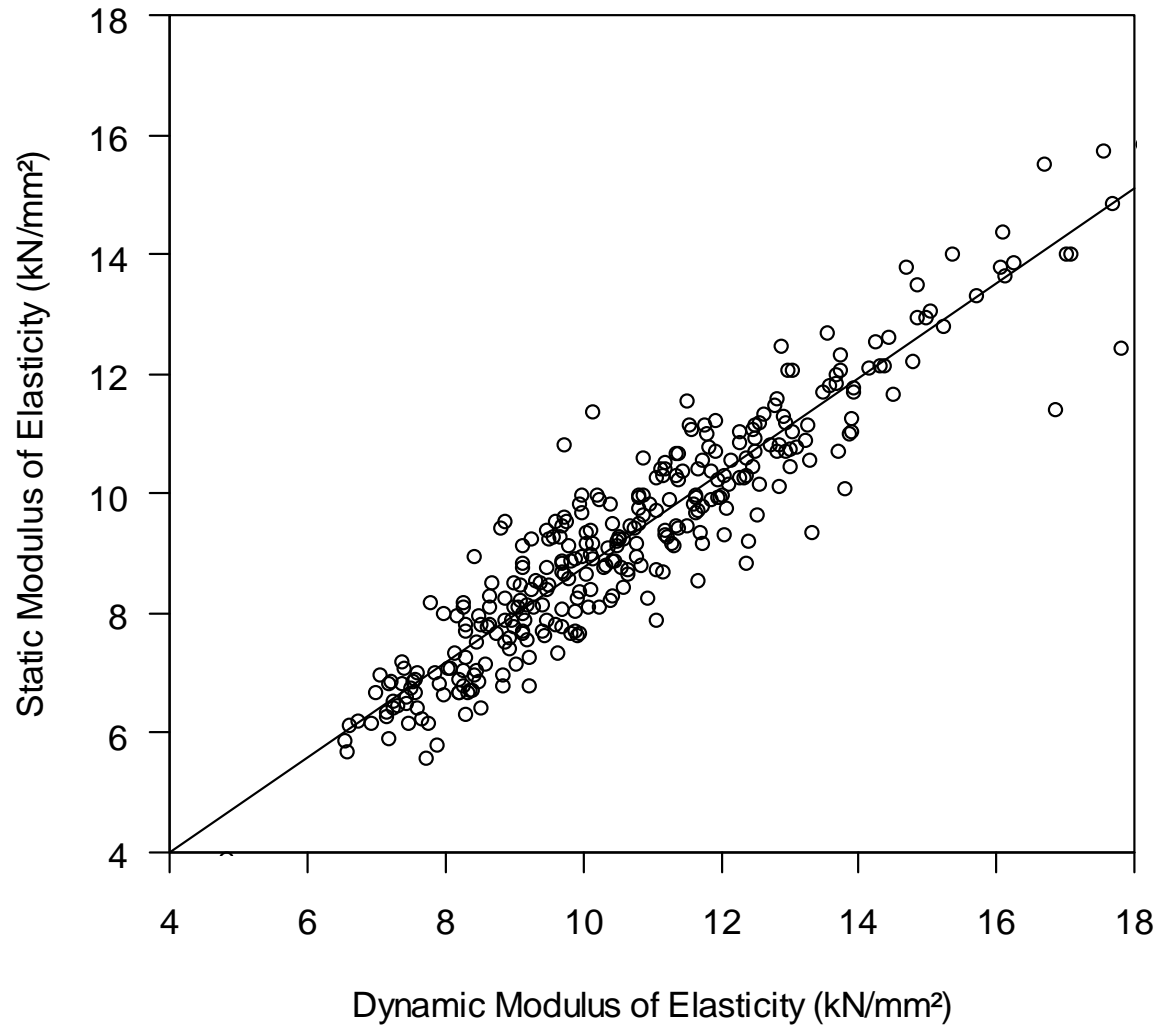
Property	Value
MOE	9.31 kN/mm <sup>2</sup>
MOR	24.2 N/mm <sup>2</sup>
Density (12%)	504 kg/m <sup>3</sup>
Basic density	418 kg/m <sup>3</sup>
Strength class	C20*



\*Strength adjusted for number of samples and their dimensions according to EN384

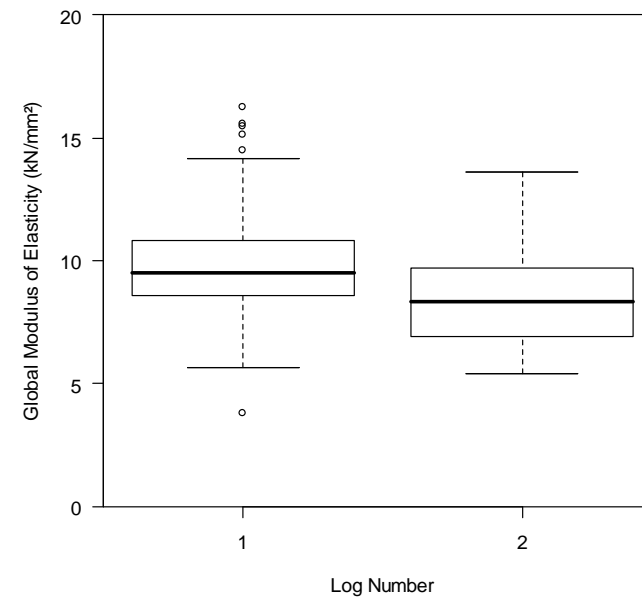
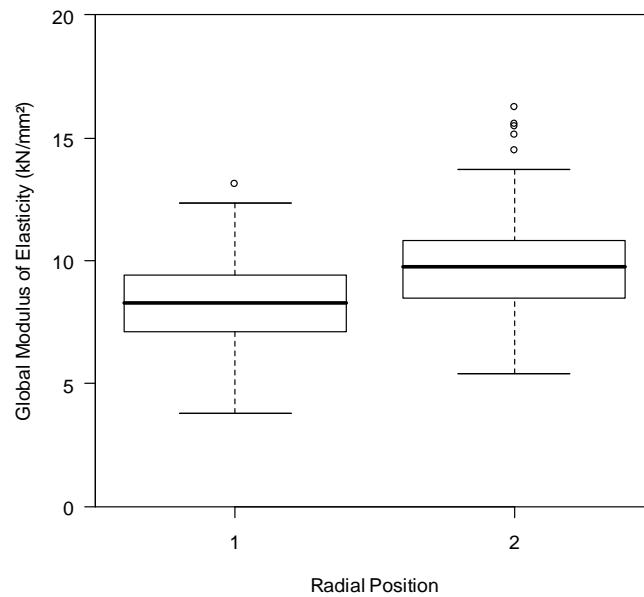
# Relationship Between Properties





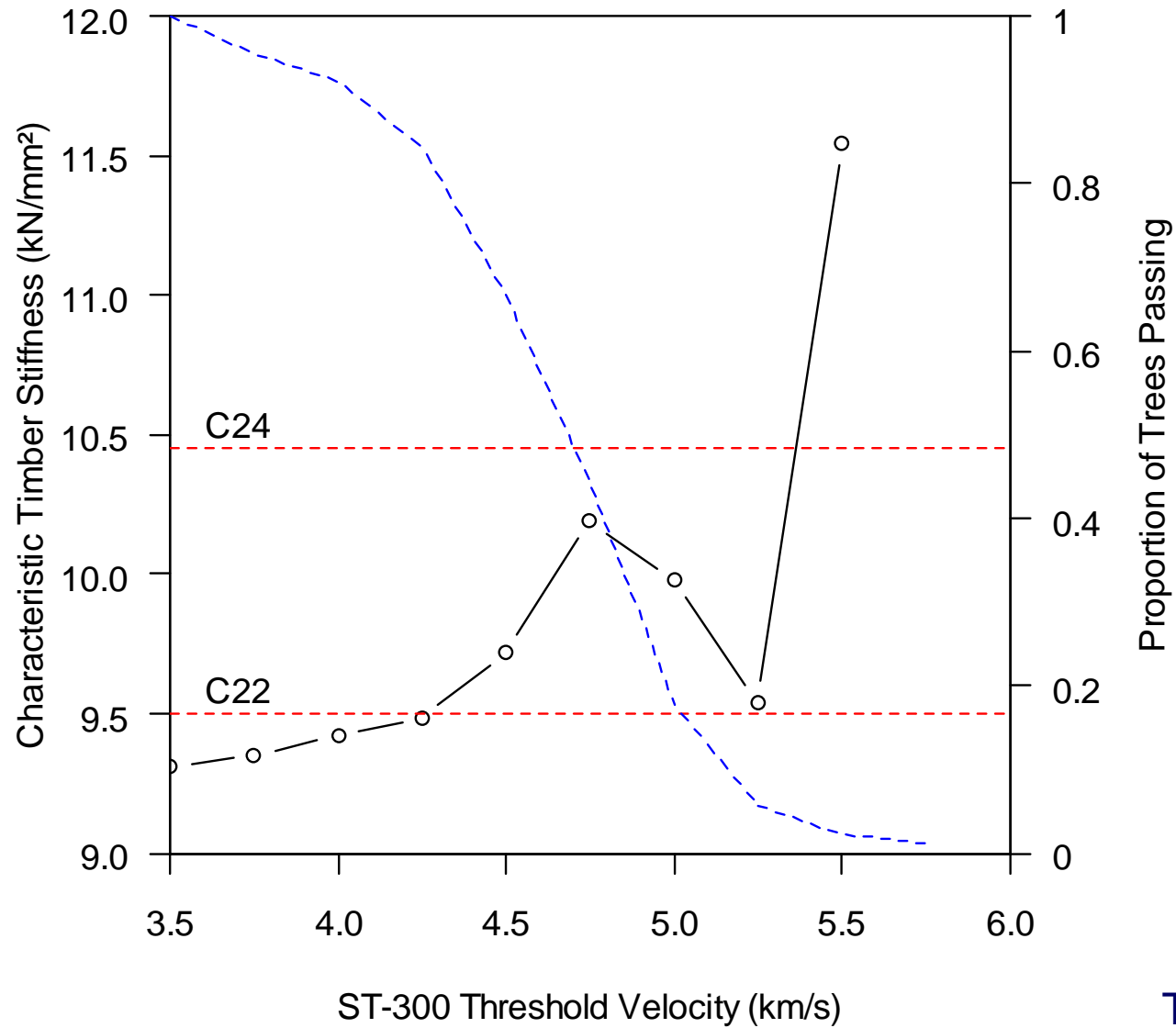
# Variation in Wood Properties

Stratum	Percentage of Variation Attributable to a Stratum		
	MOE <sub>G</sub>	MOR	G <sub>b</sub>
Site	5.59	3.39	<0.01
Plot	0.99	<0.01	0.50
Tree	24.88	7.95	9.75
Log	14.65	30.18	43.24
Batten	53.89	58.48	46.51
Total	100.00	100.00	100.00

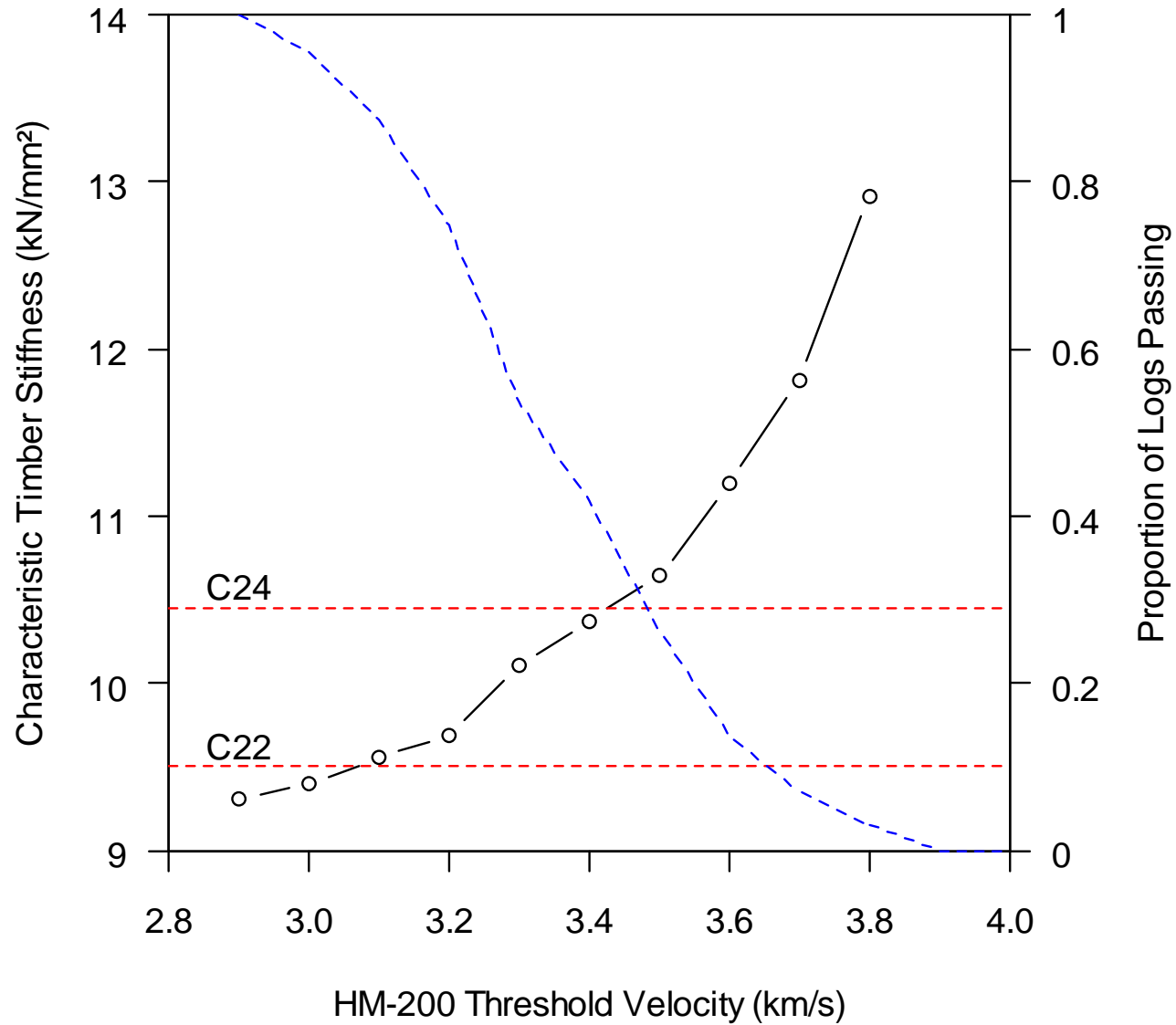




# Acoustic Segregation of Trees & Logs



Tree level



- Timber from these 3 sites met the requirements for C20 strength class
- HM-200 tool can accurately predict stiffness of sawn timber
  - Could be used as a grading tool – would need UKTGC approval first
- Stiffness appears to be a very good strength indicating property in Scots pine
- Segregating logs using acoustics offers the possibility to improve timber grade
  - Increasing strength class from C20 to C24 is probably uneconomic
  - Need to know how the characteristic values for strength and stiffness from these 3 sites compare to those from other sites

# Acknowledgements



- FC Scotland
- Cawdor Forestry Ltd.
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- Napier and FR colleagues

